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ABSTRACT

A review of the research on study techniques indicates that reading and generating questions from the material is an effective technique for ensuring better comprehension. Familiarity with a model of studying that divides studying into prereading, reading, and postreading provides one explanation for this effectiveness. In prereading, students clarify the purposes related to the study session. During reading, they go through a series of instructional episodes that include reading, a response-demand event, student response, feedback, and decisions on what to do next. In postreading, students employ strategies to enrich learning. The self-questioning technique provides guidelines for how to divide the reading material into small units, helps create a nontrivial response-demand event, and encourages students to test themselves on how well they know the material. Positive comments from students indicate that the technique is a guide, distinguishes the relevant from the trivial, and facilitates memory. Negative comments are that it is too time-consuming, the overall picture is sometimes lost, and students learn more than they need to know. Nevertheless, the technique can be a supporting activity used in a number of ways or the questions can be seen as an index to students' reading comprehension. (TJ)

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CENTER FOR THE STUDY OF READING

Reading Education Report No. 6

ANOTHER LOOK AT THE SELF-QUESTIONING STUDY TECHNIQUE

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Another Look at the Self-Questioning Study Technique

Years ago, in a now classic article, Thorndike (1917) advocated that students be actively involved in the reading process to ensure better comprehension. He further suggested that oral drill be replaced with silent reading and that students be guided "to find the answers to given questions, or to give a summary of the matter read, or to list the question which it answers ..." (p. 332). By now, Thorndike's suggestion to answer questions has a long, rich research history; and there is strong evidence that answering adjunct questions immediately after reading short sections of prose improves students' comprehension and retention. (See R. Anderson & Biddle, 1975, for a review of that research.)

Thorndike's suggestion regarding the positive effects of summary or précis writing is not well grounded in the research literature. Many of the studies concerned with this technique were reviewed by T. Anderson (1978) with the conclusion that there is little, if any, evidence to support note taking, including précis writing, as an effective study aid.

The last technique mentioned by Thorndike (generating questions that can be answered with information in the written passage) has a limited research history; only in the past several years, in fact, has it received attention. However, the technique has shown consistent, facilitative effects in studies conducted by several research groups.

How the Technique Works

One way to describe the technique is to briefly discuss several recent experiments in which it was used.

In an experiment by Frase and Schwartz (1975), 48 high school students read a 1,218-word biographical passage which was divided into three sections of approximately 400 words. Students were assigned to 24 tutorial pairs and received instructions to ask their partner questions on one-third of the text; to answer their partner's questions on another third; and to study the remaining third on their own. Each subject answered the 90-item short-answer posttest, which was tape recorded. The average total recalls for the answering, questioning, and studying conditions were 54.1 percent, 52.4 percent, and 46.8 percent, respectively. The answering- and questioning-condition mean scores, while not significantly different from each other, were significantly higher than the studying-only mean scores.

In a second experiment, 64 college freshmen read the same passage and took the same test as in the first experiment; now, however, only the first two sections of the text and the first 60 items of the test were used. The freshmen were required to read one text section and construct questions about it, and then to study the other section without questions. The questions constructed by students were compared to posttest items; the test items were classified either as "targeted" (similar to a student question), "nontargeted" (not similar to any student question), or control (covering the material that the student read without questions). The mean proportion correct for the question-generation condition was .60 and for the studying-only condition, .53, a statistically significant difference. The mean proportion correct for the targeted items was significantly greater than for the nontargeted items.

Recently, Duell (1977) examined the effectiveness of asking subjects to generate test items while reading four 552-word passages describing the psychological processes of shaping, negative reinforcement, prompting, and overlearning. One hundred-and-three college students were randomly assigned to three experimental groups. Group 1 received the four passages, a list of objectives, and instructions to write items to match the objectives. Group 2 was instructed to study the passages with a list of behavioral objectives. Group 3 was not relevant to this comparison. Post-test data revealed a significant advantage for the item-generating group.

André and Anderson (1978) reported two studies in which question-generation techniques were also used. In Experiment 1, 15 high school seniors were trained with a self-directed training package to generate good comprehension questions about the main points of paragraphs. A 'good' comprehension question used different words than were used in the passage. Item language was a paraphrase of the text; and where possible, the questions asked for instances of the concepts and principles. A second group (control group) of 14 students was asked to carefully study the same prose material in preparation for a test of the material.

On a second day, all students were asked to study two 450-word passages and then to take a comprehension test. The criterion test had items covering passage main points and details. The control group read and reread the passage as often as they wished, while the questioning group read and generated questions. The results showed that the lower ability students (i.e., those who scored lowest on a verbal ability test) were greatly facilitated by the treatment, but the higher ability students were not.

The performance of the lower ability students who used the questioning technique was 65 percent higher than their read-reread controls, while the higher ability students showed a 12 percent decrement compared to their read-reread controls.

In Experiment 2, larger numbers of students were used and another treatment group was added. The additional group received no training in generating questions, but was directed to generate questions as they read during the second session when studying the two passages. All other procedures were very similar to those used in Experiment 1. The results showed that the questioning-with-training group scored higher than the questioning group, and significantly higher than the read-reread control group. Again, the use of questions during study appears to be particularly beneficial for low-verbal ability students. For example, the performance of the high-ability questioning-with-training group improved only 2 percent over their read-reread controls, while the middle-ability group improved 14 percent and the low ability group improved 164 percent relative to their respective controls. It was also found that the probability of answering a question correctly on the posttest, provided that a matching 'good' question had been generated during the study period, was .80 for either the trained or the untrained group. The probability of answering items correctly on the posttest with less than adequate questions generated during study was about .57.

In summary, five recent investigations are available which support the use of the questioning technique. This is impressive because, with the exception of research on the use of adjunct questions, it is difficult

to find five studies which show support for any type of study technique. However, because the reader must not maintain the impression that the self-questioning technique is infallible, studies by Pederson (1976), Bernstein (1973), Morse (1975), and Owens (1977) should be noted. These investigators failed to find an effect for student questioning, and there seems to be no common thread to account for this fact.

Why the Technique Works

Why does the self-questioning technique work? Understanding one possible explanation requires familiarity with a model of studying that my colleagues and I are currently developing (see Anderson, 1978). Briefly, we see studying to be a series of activities which divide into three stages: (1) Pre-reading, (2) During Reading, and (3) Post-reading. In the Pre-reading stage, the students' primary task is to clarify, as much as possible, the purposes related to the study session. When adjunct aids such as outlines, notes, and copies of previous tests are available, the task is rather easy. When they are not, the students must make educated guesses regarding the pruposes by relying on their knowledge of the world and the specific characteristics of the text. Decisions regarding the purposes of study, which students make as a result of surveying the text and available adjunct aids, form the basis of strategies the students will use to process text in Stage 2 of the model.

Student activities in Stage 2, During Reading, are usually consistent with a so-called 'metacomprehension model' which is composed of a sequence of instructional episodes. [We use the term metacomprehension because

it is essential when studying to not only know the content (comprehension), but to know you know it (metacomprehension).] Most episodes include the following components: (a) information presentation (reading text), (b) a response-demand event, such as a question, (c) student responding, (d) response judging and feedback, and (e) decisions concerning what-to-do-next. An episode may be a very long one, such as reading a 10-page chapter followed by a quiz which is scored and returned to the student; or it may be a much shorter episode as represented by a frame in a programmed instruction text. When studying is thought of as a series of instructional episodes, the pressure is on the student, not their teachers, parents or a computer, to know when and how to implement the various components.

An example of how the model works is presented next. In this case, the purposes for studying a section of text have not been clarified, and during the Pre-reading stage, the students have had to guess what the purposes might be. Students then typically start reading the first chunk of text. The process continues until the student is interrupted by either a response-demand event, or an automatic monitoring mechanism. The automatic monitoring mechanism is a series of subconscious metacomprehension processes which operate in such a way that students can often report either a 'click' of comprehension or a 'clunk' of comprehension failure. (See Anderson, 1978, for a discussion of the additional information available on the automatic monitoring mechanism, meager though it may be.) At any rate, the students are interrupted by automatic monitoring mechanism 'noises' or response-demand events. If a response-demand event, such as a question, can be answered adequately, the student continues reading the

next chunk of text. When comprehension fails--that is, the automatic monitoring mechanism repeatedly reports clunks and/or the response-demand events are responded to inadequately--the student faces a difficult decision. Should the fact that comprehension failed prompt the student to (a) change strategies adopted in Stage 1, (b) investigate the particular automatic monitoring mechanism or response-demand event to determine if it was perhaps a false alarm, or (c) initiate one of several fix-up procedures (e.g., reread, jump ahead, consult an outside source, or think/reflect on the failure)? If a student fails to make a good decision, the outcome may be serious; to employ an inappropriate strategy may result in frustration, mastery of trivial knowledge, and/or no mastery of anything.

The reading session continues in an episodic fashion, and as the purposes are clarified, the response-demand events and automatic monitoring mechanisms are fine-tuned in accordance with them. If students know that, later, they will be tested over the text material, they frequently opt to take notes or use some other form of bookkeeping. Often, notes can be helpful during Stage 3 of the study process, i.e., the Post-reading stage.

In Stage 3, students employ strategies to enrich learning and increase the probability that the material learned will be retained. When the study purposes are explicit, it is most sensible for the students to engage in activities that are as close as possible to the performance aspect of the purposes in terms of time, format, and content coverage. For example, if the student knows the questions that will be asked on a test, the most appropriate study activity is to practice answering those questions without using available text immediately before taking the test.

In what activities should students engage when the purposes are implicit? In one sense, any of the organizational (outlines), translational (paraphrases, generated questions), and/or repetitional (recitation, rehearsal) schemes can help students remember what they have learned. However, the chance exists that engaging in these schemes will burden the students with unnecessary busywork, so choosing an appropriate one is an important decision.

Now, the question posed earlier can be addressed more fully: Why might the self-questioning technique work? First, it provides guidelines about how to chunk the reading text into small units. In some research, the rule is to chunk material into paragraph units, but certainly other divisions may apply. For instance, text may be divided at the end of units or chapters, or when significant dates or technical terms are encountered.

Second, the technique helps create a non-trivial response-demand event, i.e., generating, and probably answering, a question according to preestablished guidelines and a specific text and context. Third, the process encourages students to use their metacomprehension skills; that is, it encourages them to test themselves on how well they know what they know, and to take corrective actions when they discover that comprehension has failed on a substantial portion of the text. The student must decide which portion of the content should be the basis for the question and which is irrelevant. To discriminate in this manner, and to construct a question about the important points of the paragraph, requires students to process the meaning of most of the paragraph.

An Informal Critique of the Technique

To learn more about why the technique works, 15 college students were asked to study 23 pages from their educational technology textbook, Rowntree (1974), using a questioning technique. They were successful students by academic standards, and I was eager to see the quality of questions they would generate as well as their introspection about the pros and cons of the technique. The following written instructions were given to each student: (1) Survey the chapter by reading the introduction; by leafing through the chapter and noting the visual aids, i.e., pictures, graphs, tables; and by reading the chapter summary. (2) Read carefully the first (next) paragraph. (3) Determine the most important point (or points) that the author makes in the paragraph. If you can, underline those points. (4) Write a question which requires knowledge about an important point in order to answer it correctly. Do not write an answer to the question. (5) Repeat Steps 2, 3, and 4 until you complete the chapter.

Merits of the Technique

Presented next are some of the more pertinent comments that the students made regarding the value of the question-generating process. Bear in mind that they were not in my class, nor did they attend my university. In fact, the first time they saw me was during the five-minute session in which I gave the homework assignment. In other words, they probably were not conforming their remarks to fit my expectations because I am sure they did not know beforehand what type of comment I wished to hear.

One group of comments suggests that the technique aids and checks comprehension. 'By questioning frequently, the student must concentrate

deeply and constantly on the text material throughout the reading assignment.' 'Each point is given time to penetrate because the student must think about it while formulating the question.' 'Questioning after each paragraph serves as a guide to understanding.'

Other comments report that the technique helps to distinguish main points. 'The questioning process helps the student distinguish the important and relevant points from the trivial and irrelevant material.' 'The technique is especially valuable in this respect because it requires the student to focus specifically on only the most important points in the text.'

Still other comments state that questioning facilitates memory and maximizes learning. 'The questioning technique requires a thorough study of the text, the result being that the student is more likely to remember details as well as main sequences.' 'Also, the questions are a useful memory jerker for revisional purposes.' 'Generating questions allows the student to get everything out of a chapter and prohibits the student from escaping with a superficial reading of the material.'

Finally, one student commented that the technique economizes bookkeeping. 'By writing only one question after each paragraph, the student is forced to write far less than when précising or summarizing the text.'

Drawbacks of the Technique

Objections to the technique centered around three areas. The first emphasized that generating questions for each paragraph was too time-consuming, laborious, and boring. (The students' time records revealed that the assignment required approximately two to five hours to complete.)

The second major criticism was that the broad, overall picture was sometimes lost with concentration at the paragraph level. A third objection, and perhaps not a major one, was that the questioning technique assumed that students needed a "total understanding" of the text. By employing the technique, the students learned more than they needed to know.

Being an optimistic advocate of this technique, I suspect that the above objections could be resolved for many students by adjusting the rules regarding how to chunk material and when to generate questions. Generating a question after each paragraph may be too often for most study purposes. With additional practice and experimentation, we soon may be able to shed some new light on this problem.

Conclusions and Recommendations

As portrayed in this paper, some interesting, relevant outcomes occur when students generate questions while reading text. The effects seem to be most pronounced with students in middle to low ranges of verbal ability. Also, all of the research mentioned earlier has been done with teenagers and young adults, and it is difficult to predict how it will work with children. Other lines of research demonstrate that children have much more trouble with metacomprehension tasks than do young adults, thus suggesting that children will find question generation difficult to do.

Recommendations will be made in two general categories. The first category concerns the situations in which the generated questions are an interim product. That is, the list of questions is not a document to be judged for its own academic merits. Rather, it is a useful auxiliary to

some other activity (e.g., taking written or oral exams, writing papers, or discussing material). The questioning technique may take several forms in this auxiliary mode. The following paragraphs outline various recommendations for using the self-questioning technique as a supporting activity.

1. During periods of sustained silent reading, students should frequently generate questions regarding important text material to be learned.

2. Students can initially study text material without generating questions, then question one another in "study pairs." (See Frase & Schwartz, 1975, for details of this technique.)

3. Students can assist one another in preparing for a test by collecting and recording (e.g., on a ditto master) all questions generated in Recommendation 1 so that each student can be supplied economically with a copy of all the questions that are generated by a group. This master list can aid students in reviewing for the test as well as help the teacher in designing an exam.

4. Student-generated questions may also be used in a game-playing situation. An exemplar game is played by two teams of about ten students each. The students each generate questions as in Recommendation 1. The first member of Team A (using his list of generated questions) asks the first member of Team B to answer one of them. The Team B student may either choose to answer the question or defer it back to Student 2 in Team A who then must answer it. The first member of Team B then asks the first member of Team A a question. Again, Team A's member may choose to answer or defer the question to the succeeding member of Team B. The process continues until each team member has asked at least one question. To score the game,

each team gets one point for a correct answer, minus one point for an incorrect answer, and no score for a pass. In games like this most students will be encouraged to produce reasonable questions and accurate answers.

5. Finally, student-generated questions can be used as a first step in preparing a written document. Consider this procedure: (a) collect evidence from reading in the form of questions; (b) answer the questions later (one per 3 x 5 card) to test for an understanding of the chosen topic; (c) organize answers (cards) into an outline or other representational form; and (d) prepare a first and then final draft of the document from the outline.

The second category of recommendations is based on the premise that a list of student-generated questions can stand alone as a reliable index of reading comprehension. That is, the quality of the questions reveals what the students have learned or failed to learn from reading the text. André and Anderson (1978) report the use of a rating-scale approach to judge the adequacy of student-generated questions. Results from that scale were consistent with the researchers' expectations in that the quality of the questions was closely related to posttest performance.

Other criteria would also be applicable in judging the adequacy of student-generated questions. For example, Carman and Adams (1972) list a series of "clue words" which are important to recognize when taking an examination. According to them, the six most important words are: contrast, compare, criticize, define, describe, and list. A teacher might use this list to gauge how precisely students are able to "aim"

their questions and to put boundaries on the intended answers. For example, Nunnally (1964) uses the following example of two questions which supposedly test the same concept: (a) What are Newton's laws of motion? (b) Describe each of Newton's three laws of motion. Illustrate each with the action of the ball in a game of baseball. Somehow, one can feel more confident about the knowledge of the author who wrote the second question than of the one who wrote the first question. This feeling leads me to the conclusion that the assessment of question quality holds an interesting research and pedagogical future.

Also, lest the obvious be overlooked, another index of question adequacy lies in whether or not the question is "aimed" at the appropriate text content. If questions are intended to aim at main ideas of text units (about ten paragraphs) and the student-generated questions probe at insignificant details, then the required comprehension remains in doubt.

The final recommendation is that teachers and researchers devise and validate procedures for assessing the quality of student-generated questions. In this way, questions generated during the self-questioning study technique might become a recognized index of comprehension and be added to the library of teacher-assessment istruments.

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